



Design Review 3

To: Drs. Venkata Yaramasu and Kyle Winfree

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Introduction:

The objectives and goals of the project are to develop the next generation large-scale PV system interfaces with integrated energy storage for improved energy efficiency, reduced manufacturing cost, enhanced system reliability, and grid code compliance with proper control. Also, help calibrate the time expectation for the project. Our team is included Khaled Albannai, Mohamad Elsaleh, Xuanyu Bai, Jiaxin Zheng and we are working with our client Dr. Yamasu. This is the Design Review 3 documentations it will help us as a group to follow the schedule and think about what are the challenges might lie ahead. In addition, we discussed more in detail about the project, WBS Activities, WBS Tasks, WBS Deliverables, Risk, Challenges, and Resolutions.

WBS Overview:

As we can see in the WBS we clearly identified the Activities/Task, the description and deliverables above, and here is the table of WBS.

Section	Activity/Task	Description	Deliverable(s)
1	Hardware		
1.1	Metal board stand	Installing the board stand	A complete moveable stand
1.2	Buying stand board	Measuring and layout the board with precise measuring	To measure the correct parts sizes for all components
1.3	Purchase Components	12 capacitors 12 capacitors metal attachments 1 big inductor 12v wires	To have all the components we need to build the converter

1.4	The show stand	A standing board that holds all devices on it	A stander with the measured size
2.0	Cutting/ Drilling		
2.1	Metal for gate drivers	Measure and make it fit perfectly on the metal 3 sheets	Attaching all 12 gate drivers
2.2	Drilling holes on the board for components	Drilling the correct for all converter components	Make it easier and faster to attach the components
2.3	Cutting metal sheet for the safety device	Cutting and drilling the sheet to make it fit	Attaching the safety board to the metal sheet
2.4	Wood board for the stander	Cutting from a big wood board by a measured size.	The complete wood board in a measured size
3.0	Assemble units		
3.1	Attaching components	6 Small Inductors 1 big Inductor 12 capacitor 12 gate drivers All on the wooden board in the correct positions	Attaching 90% of the inverter components
3.2	Attaching the IGBTs On the Heat sinks	All 12 IGBTs on the 3 heat sinks and then on the board	To fix the heat sink / IGBTs on the board
3.3	Preparing for wiring	Tidy the board, leave enough space for wiring between the components	In good positions.

4.0	Wiring		
4.1	Wiring Phase 1	4 IGBT 2 inductors 4 Capacitors 4 gate drivers	Wiring all the converter three phases
4.2	Wiring Phase 2	4 IGBT 2 inductors 4 Capacitors 4 gate drivers	Set up all the components properly
4.3	Wiring Phase 3	4 IGBT 2 inductors 4 Capacitors 4 gate drivers	Set up all the components properly as well
4.4	Wiring the 3 Phases to Sensors	Connect the Phases to current and Voltage sensors	Making sure all phases are connected to the sensors
4.5	Wiring phases to the interface board	Wiring with high precision	Wire all 3 phases
5.0	Testing		
5.1	Interface board testing	Testing the interface board base on the MATLAB Simulink	Simulink running well without any errors
5.2	System testing	Running the complete system with MATLAB and dspace control	The system running without any errors

WBS Activities:

1. Hardware

For this project, understanding and coming up with a list of materials/hardware requirements was the first step. After the acquisition of this list through initial project analysis and further client meetings we came up with a list of items necessary for this project. The following items are representative of all the materials required to ensure the completion of this project.

- Inductors
- Capacitors
- Board stand
- Wooden board
- IGBT's
- Wires

These items were ordered by our team with funding provided by our client.

2. Soldering

After acquiring all the items, we started by soldering parts in a systematic manner and carefully testing every part as the process went on. This method ensured low rates of error and allowed us to create proper connections. The following items were soldered:

- Gate driver's
- Current sensors
- Voltage sensors
- Interface board

3. Cutting/ Drilling

To put things together and create a physically stable system, we had to come up with a design which allowed us installing all the parts carefully with ease. We decided to use a wooden board and steel sheets to overcome this challenge.

4. Assemble units

Our converter has three phases, each phase is made of:

- 4 capacitors

- 4 IGBT's
- 2 Inductors
- 4 Gate driver's
- 4 Shunt Capacitors

After building each phase we will connect them down to a three-phase inductor and to a safety switch.

5. Wiring

This process requires us to connect all the components together by following the circuit diagram given by our client, but first, we need to measure the distance of each component and cut the wires accordingly.

6. Testing

One of the most important parts of this project is ensuring all the systems and interfaces are working perfectly in tandem. To achieve this goal, we have dedicated significant time and resource for testing all the parts. This includes interface board testing and system testing. Testing MATLAB Simulink will be vital as it will ensure no errors are being reported.

We listed all the activities in the WBS above in order to make it clear to read and understand. We as a group we almost always working together and sometimes, for example, we have some team members are working on testing and the other team members are working on hardware part such as assembling components.

WBS Tasks:

1.Hardware

- Metal board stand
- Buying stand board
- Purchase Components
- The show stand

2.Cutting/ Drilling

- Metal for gate drivers
- Drilling holes on the board for components
- Cutting metal sheet for the safety device
- Wood board for the stander

3.Assemble units

- Attaching components
- Attaching the IGBTs On the Heat sinks
- Preparing for wiring

4.Wiring

- Wiring Phase 1
- Wiring Phase 2
- Wiring Phase 3
- Wiring the 3 Phases to Sensors
- Wiring phases to the interface board

5.Testing

- Interface board testing
- System testing

Each team member is responsible to complete his/her given task. We divided all the work evenly between the team members, we listed some of the tasks and who is responsible for it below:

Khaled and Mohamad:

- Hardware, Section(1.1, 1.3)
- Cutting/ Drilling, Section(2.2, 2.3)
- Assemble units, Section(3.1, 3.2)
- Wiring , Section(4.1, 4.2, 4.3)
- Testing, Section (5.1)

Bai and Zheng:

- Hardware, Section(1.2,1.4)
- Cutting/ Drilling, Section(2.1, 2.3)
- Assemble units, Section(3.3)
- Wiring, Section(4.4, 4.5)
- Testing, Section (5.2)

WBS Deliverables:

Our team is required to deliver the best product which is the converter to the client. Based on his needs and converter requirements, such as being high stander as buying it for a third-party manufacturer. In addition, our team will make sure to follow and satisfy the client with the final product. On the other hand, we have listed below what the team has done of progress in the converter and what are the requirements:

1.Hardware

- **A moveable stander**
- **The correct size of components**
- **Converters**
- **Interface board**

2.Cutting/Drilling

- **Total of 12 gate drivers**
- **The metal sheet**
- **A show stand board**

3.Assemble units

- **All the components set up on the board**
- **Total 12 IGBTs**
- **Complete three phases in the correct position**

4.Wiring

- **Three phases in their correct connection**
- **Inverter connected properly**
- **Current and voltage sensors connected properly**
- **All the interface board in their correct connection**

5.Testing

- **Interface boards can run without any errors**
- **Whole system working properly**

Risk, Challenges, and Resolutions:

Project challenges/solution:

- One of the big challenges we have to solder 12 gate drivers, voltage sensors, current sensors, and interface board. No one of the team members have experience with soldering, so we have to make sure to solder correctly. In the other hand, we have soldered all of the components but when we tested some of the devices are not working, so the challenge now to find which component is placed incorrectly and we have to fix it.
- The second challenge is attaching the inverter components vertically on the board and make some of the long connections behind the board to make it more organized and industrial standard as our client requested.

- The third challenge is when we solder all 12 gate drivers and tested them all are working perfectly except all LEDs were not working. We found that we used the wrong size of LED, and we had to desolder and solder the right size of the LED.
- The fourth challenge is interface board testing base on the Matlab, the team has to install the gate driver over and over again with complex wiring. Making sure the Matlab Simulink is working properly. In this case, we made wires keep in the same order so that it's easier to make the connection every time when we reinstall the gate driver, at this way we saved time to finish work.
- The fifth challenge is the construction part, the team needs to cut a big metal board to get a good size that can be used on our show stand. It takes a lot of time to do the measurement, the team also need to punch on the metal board using a perforating machine which is a danger to work within the process.

Conclusion:

In this assignment, we discussed more in detail about the project, WBS Activities, WBS Tasks, WBS Deliverables, Risk, Challenges, and Resolutions. In addition, how our team is doing in the project and we are in a really good stage right now. This assignment is very helpful to see where we are and how we are following the correct path to be able to deliver a working inverter before the end of the semester.